

GUIDELINES FOR

**THE PACKAGING AND STORAGE
OF PESTICIDES**



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



COMMUNITY HEALTH CELL

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1. GENERAL REQUIREMENTS

- 1.1 Pesticide containers and related outer packaging should comply with all national standards and regulations which apply to packaging, and where required, with international transportation and safety regulations.
- 1.2 The shelf life for container and product should be established as at least two years. In the event that the life of the product is shorter, the expiration date should be clearly imprinted in a prominent place.
- 1.3 Pesticides should only be packaged in clean and dry containers designed to provide protection against product deterioration, compaction, weight change or other spoilage. Containers must withstand all anticipated levels of handling, storage, stacking, loading and unloading conditions and should not become adversely affected by changes in atmospheric conditions, pressure, temperature and humidity. Standards of performance should be established through accepted test procedures.
- 1.4 The inner surface of containers or closures may be coated or lined with substances or materials which have been tested to resist corrosion. When such coating, linings or materials are used they should not contain substances which could react with the contents, form other compounds, or weaken the overall structure.
- 1.5 Outer surfaces of pesticide containers must be constructed of, or be coated with, materials which resist corrosion or other deterioration and which will accept either printed label copy, or the attachment of a printed label. Labelling should be positioned so as to be readily identified and should remain legible and attached throughout the anticipated shelf life.
- 1.6 Inks used for printing, labelling, codes or expiration dates, should be color-fast and resistant to weathering. Tests established for one container or label may be applied to other products using similar containers and formulations.
- 1.7 Containers of a specific design which have been qualified through tests performed for one specific product, must be retested if they are to be used with another product, or with a new formulation of the existing product.
- 1.8 Inspection procedures should be established at container filling sites which assure that the quality of pesticide containers is maintained.
- 1.9 All liquid containers should have an ullage of at least 5%.
- 1.10 Reused or reconditioned packaging should meet the same standard as the original packaging.

2. PESTICIDE CONTAINER STANDARDS

General

All pesticide containers shall protect both the active ingredient and the qualities of the formulation for a period of two years to an acceptable level. The external surfaces of the container shall not have been, nor shall

become contaminated with the content. Each container type and formulation should be tested before distribution by the test procedure required. The results of these tests shall be recorded. At the time of initial manufacture and distribution, representative samples shall be further tested under worst case ambient conditions, to provide confirmatory results. In the event that the shelf life is less than two years, each package must be clearly marked with an expiry date.

All containers and formulations used in testing shall be manufactured from materials similar to those used at the time of product distribution. In the event that the size or shape of the container or the thickness of the walls or the coatings is changed for distribution, then the test procedure will be repeated.

Closures shall be tested together with containers. Changes of closure type, coatings or liners, shall require repeated testing.

Where required, impact or drop tests will be performed to the required test procedures and the results recorded.

2.1 Inside Containers

Inside containers are defined as those which require an overpack to provide protection during shipment, handling and storage. Inside containers may be removed from overpacks for sale or display.

2.1.1 Bags containing not more than 10 kg

Bags shall be constructed of one or more plies of paper film or aluminium foil. Bags will be tested by approved procedures for compatibility and resistance to impact.

2.1.2 Bottles containing not more than 1 kg or 1 L

Bottles shall be fitted with closures, which in the case of liquids, will not exceed 63mm. Polyethylene or other plastic bottles shall only be constructed from resins having a known high level of resistance to environmental stress cracking. Bottles will be tested by approved procedures for compatibility and resistance to impact. Similar conditions shall apply for plastic containers not exceeding 1 kg or 1 L capacity.

2.1.3 Metal containers containing not more than 10 kg or 20 L

Metal containers shall be constructed from steel, which may be coated with tin or other materials, to provide compatibility with the content and external protection. In addition metal containers for liquids shall use a gasketing compound at seams which are not joined by welding. Metal containers shall be fitted with closures, which in the case of liquids will not exceed 63mm. Metal containers will be tested by approved procedures for compatibility and resistance to impact.

2.2 Overpacks

Overpacks are defined as containers, such as boxes or cartons, which provide essential levels of protection to one or more inside containers. Overpacks shall be sufficiently rigid to prevent compaction or other damage to contents. Where required internal packing materials should be used to assist in protecting the contents.

2.2.1 The quality of board used for overpacks shall not be measured as less than 190 g/M² when tested by the approved procedure.

- 2.2.2 Overpacks shall be drop tested while containing inside containers filled with water or other suitable inert material by the approved Procedure.

2.3 Bulk Containers

Bulk containers, are defined as rigid wall packages which may be metal, polyethylene or fibre drums or heavy duty corrugated paper boxes.

2.3.1 Drums containing not more than 250 kg or 200 L

Drums shall be constructed from steel, which shall be coated internally with a rust preventative or corrosion resistant medium and externally so as to be rust resistant. In addition, all seams not joined by welding shall use a gasketing compound. Polyethylene drums shall be manufactured from resins with a known high level of resistance to environmental stress cracking. Fibre drums and corrugated boxes, manufactured from paper, shall be internally lined with sealed polyethylene bags, having a thickness of not less than 0.05 mm. The size of closures for liquid containers shall not exceed 63 mm. Bulk containers shall be tested by approved Procedure for compatibility and impact resistance.

3. SELECTION OF APPROPRIATE PESTICIDE CONTAINERS

3.1 Solid products - powders, dusts or granules

- 3.1.1 Small packages, usually up to 3.0 kg capacity, can generally be selected from ready made packaging, such as bags, pouches, canisters, cans, glass or plastic jars.

3.1.1.1 Bags or pouches should be manufactured so as to be leakproof through bottom and sides. The top will be open for filling, and must subsequently be sealed so as to become leakproof, usually through a combination of heat and pressure, using a standard heat sealing device. Bags and pouches are often manufactured with more than one ply of material. The inner ply will usually be polyethylene film, which is useful for sealing, provides an excellent moisture barrier and is resistant to attack by most chemicals. The thickness of this film should not be less than 0.02 mm. Thicker films, up to 0.05 mm are often needed to achieve leakproof seals after filling.

3.1.1.2 Canisters and cans should be manufactured with leakproof bottoms and tops for filling. Canisters use layers of paper to form the body, which can be embedded with polyethylene or other materials, such as aluminium foil, to develop necessary barrier qualities. Canisters can be made with round or rectangular section. Cans are normally manufactured from tinplate, thin steel sheet coated with tin on both sides, and can also be round or rectangular. Tinplate normally provides good environmental and chemical protection, making it a useful packaging medium. Occasionally, corrosion occurs, which is preventable through use of an inner coating. These coatings can only be satisfactorily applied to round cans. When required, outer coatings of paint or varnish can be applied.

There is a variety of closures for canisters and cans, the most useful in the case of solids, being the replaceable plug. When controlled application is needed, sifter tops in tinsplate and plastic are available. Screw on closures are also available.

- 3.1.1.3 Glass or plastic jars are one piece containers comprising bottom and body, manufactured for top filling, and are often available in standard sizes. Glass is seldom corroded by pesticide formulations but is seldom used for packaging solids. Plastic jars made from polyethylene are particularly useful, due to their moisture barrier and shatterproof characteristics. Other plastics may be used for jar manufacture at some cost to overall packaging qualities.

Closures for glass and plastic jars should be of the screw-on type, unless an alternate closure is shown to have sufficient retentive capability.

- 3.1.2 Large packages, typically sized between 10 and 30 kg, can be selected from sacks, fibre, plastic or steel drums or corrugated boxes.

- 3.1.2.1 Sacks should be manufactured so as to be leakproof and may be filled through an open top or through a valved opening. The valved sack is to be generally preferred in many operations, since any dust generated in filling, is easier to control and there is no requirement for closing, other than, with some designs, having to fold and tuck the valve. Sacks may be manufactured entirely from polyethylene film or from layers of paper and film, or other barriers. Sacks which are open at the top for filling will be subsequently closed either by sewing or heatsealing. Sewn tops are not leakproof for dusts and powders and do not provide moisture resistant seals unless special over-taping methods are employed.

Valved sacks manufactured from multiple layers of paper will usually have minor leak points at the top and bottom, due to the manufacturers difficulty in controlling the requisite folds and their adhesion. However, when made from polyethylene, valved sacks can be expected to be fully leakproof.

When filled with powders and leakproof closed, sacks will always contain some entrapped air. Since this takes time to dissipate, there is often difficulty in stacking filled sacks on pallets. It is therefore desirable to have a means of venting the container, usually accomplished through perforations through the inner plys of multiple ply sacks, or through one-way venting systems with polyethylene sacks. Air can be removed through vents by squeezing the sack in a horizontal position with the product evenly distributed. This can be done by use of a weight, or by two appropriately spaced roller conveyors, set one above the other.

- 3.1.2.2 Fibre, plastic or steel drums will usually be standard sizes. Linings are often used in the form of polyethylene bags either for moisture protection or to reduce drum contamination and ease cleaning for reuse. The drums will have full size removable heads, which

should have been capable of being locked on after filling, so as to maintain integrity through rough handling.

Fibre drums are manufactured from layers of paper and can have polyethylene or other barriers such as aluminium foil embedded. Plastic drums are manufactured from polyethylene, providing an excellent moisture barrier. Steel drums will provide maximum protection and can be protected against corrosion either by use of coatings or polyethylene bags.

The use of any of these large rigid containers provides excellent protection against compaction.

Drums can all be closed, using a variety of heads. Since gasketing is frequently used, it is important to check compatibility.

3.2 Liquid Products

3.2.1 Small containers, sized up to 5 litres, can generally be selected from available stock packaging. Types used are cans, or bottles with necks, made from glass or plastic.

3.2.1.1 Cans should be manufactured with leakproof ends which use gasketing compounds at the interface with the body. Side seams should be welded or soldered. Cans, which are manufactured from tinplate, usually provide excellent protection to liquid formulations. In the event that additional internal protection against corrosion is required, coatings can be applied to round cans.

Care should be taken to ensure that minimal volumes of water are present in cans or formulations at the time of packaging to avoid the development of rust and pinholes. Defective compound and side seaming and the presence of water are major causes of can failure.

Glass or plastic bottles with necks are useful for liquids, since they enable pouring without spill.

Glass bottles are excellent for chemical packaging, due to characteristic inertness, but are more liable to break or shatter during a typical life cycle. Some plastic bottles, usually made from polyethylene, are useful for containing formulations without solvents. However, new developments in this field have overcome the problem with deterioration by solvents. Special care must also be taken in the design of outer containers for small plastic bottles, to protect them from becoming crushed when stacked during storage. Under these conditions cracks readily develop and leaking occurs.

3.2.1.2 Closures for small liquid containers should be of the screw-on type and for ease of pouring should be sized in relation to the viscosity of the formulation, thicker products requiring larger openings. The two most useful sizes being 38 and 63 mm. The closure liner should be compatible with the product and should also afford a good seal at the interface with the top of the neck.

3.2.2 Large liquid containers, typically sized between 10 and 200 litres are usually of standard varieties, such as jerry cans and drums manufactured from steel or plastic. Liquids should always be packaged in containers with closed heads. In the case of drums the head should be seamed or welded onto the body. Individual openings for dispensing from large liquid containers should not exceed 63 mm but two openings should be placed in the head to improve pourability. In some instances, provisions may be made for a suitable pouring device.

3.2.2.1 Steel containers provide very high levels of strength, with consequent resistance to damage during handling, transportation, storage and stacking. They can be coated internally with a variety of materials which provide resistance to corrosion. Internal coatings should be used and selected with great care to avoid incompatibility. In addition, consideration should always be given to the risk of coating failure, due to incorrect manufacturing procedures, becoming the cause for major defects. Seaming compounds are used to seal the interface between drum ends and body. Rubber, elastomer or plastic gaskets are used to seal the closures. As with small containers, care should be taken to avoid the presence of water when filling.

3.2.2.2 Large plastic containers, usually constructed from polyethylene, are either self-supporting or require an overpack, in the form of a steel drum or a corrugated box. These containers provide excellent protection against moisture, particularly due to the weight or thickness of the walls. This thickness often provides an adequate barrier for the packaging of solvent based formulations, particularly when vapor pressure is low.

3.3 Pressure Packages

3.3.1 Containers which must retain the contents under pressure at ambient temperatures, should be packaged in containers designed to be pressure resistant. The gauge of the metal used for the body and heads, the means of sealing and the construction of the valve are particularly important.

The design, selection and testing of pressure containers is complex and should only be undertaken by trained persons, using carefully calibrated instruments. The shelf life of pressure containers is often less than two years and packers are well advised to limit production in coordination with consumption.

3.4 Overpacks

3.4.1 Overpacks are used to accumulate one or more containers together and often provide extra protection for the side containers, such as protection from handling, stacking and shipping damage.

3.4.2 Overpacks can be constructed from film bags, shrink wrappings, paper or corrugated boxes, depending upon the level of protection required. The most commonly used overpack for pesticides is the box, particularly since it provides low cost, economic protection.

3.4.3 When extremely severe transportation conditions are anticipated, it is advisable to congregate a number of boxes within a wooden crate.

3.5 Closures

3.5.1 Selection of the correct closure is extremely important to successful packaging in rigid containers, especially when they contain liquids. As previously noted, the closure size for liquid containers should be determined from the rate of pour required and the viscosity of the formulation. Closure sizes for liquid containers should not exceed 63 mm, and it is useful to limit smaller sizes to 38 mm, for the purpose of standardization.

3.5.2 Closures for rigid containers containing powders or granules may be larger than 63 mm, often close to, or similar in size to the diameter of the jar or drum. Tamperproof features built into the closure, which indicate whether a container has been opened are particularly useful. Other tamperproof methods are available, such as shrink-on seals. Closure liners should be carefully selected since they greatly influence overall performance, inadequate liners are often found to be the cause of container defectives. The use of child resistant closures should be encouraged for household packs.

Closures are not designed to be in constant direct contact with the product, only with the vapor phase, and should not be expected to contain liquids when the container is inverted.

Closures should be applied to containers at a torque sufficient to maintain a seal. It is customary for the torque originally applied to reduce with time, usually within 24 hours. The correct method of measurement for closure torque is to measure the opening force.

3.6 Measuring Devices — The development and provision of suitable measuring devices as part of the container as pack should be encouraged. Whenever possible, measure packs should be supplied with the pack size being based on the needs of users in the region.

4. SPECIFICATION OF PESTICIDE CONTAINERS

Specification is not only a useful form of communication between vendor and buyer, but it is also an essential form of communication when purchasing pesticide containers, due to the critical requirements. A means of test or measurement should always be established, using agreed written methods or standard methods such as those developed by the American Society for Testing and Materials (A.S.T.M.). The use of agreed or written methods is often satisfactory for day-to-day use, with an added agreement to use A.S.T.M. methods for reference purposes.

5. TESTING OF PESTICIDE CONTAINERS

Container performance tests provide a useful means of determining prior to initial shipment the probability of the container providing the level of protection established in these guidelines. Confirmatory tests should be carried out prior to gearing up for production to ratify the efficacy of the original work. The use of specific test procedures improves communication between interested parties, such as regulatory bodies and container manufacturers and users. Test procedures can be developed with varying levels of complexity, depending on the facilities and personnel available. The determination of successful pesticide packaging can usually be done by means of practical procedures. For referee purposes, well established test procedures, such as those published by A.S.T.M or other internationally

recognized bodies should be used. Useful test procedures can be established based on the U.N. packaging recommendations, or other test procedures established by the country, those listed by the British or U.S. Departments of Transportation or those published in Chemistry and Industry No. 4, dated February 18, 1978, pages 107-115.

6. PESTICIDE CONTAINER STORAGE STANDARDS

6.1 Rules for Storing and Display of Pesticide Containers

- 6.1.1 Construct and maintain areas so that the risk of contamination to other products is avoided.
- 6.1.2 Clearly mark the area with warning signs.
- 6.1.3 Store pesticides in original labelled containers, positioned so that the label is clearly visible.
- 6.1.4 Design the area so that the chemical and physical properties of the product, shelf life, are likely to be maintained.
- 6.1.5 Separate volatile pesticides from other pesticides to avoid cross contamination and always store in an unrestricted atmosphere.
- 6.1.6 Rotate stock to avoid expiration of shelf life if the product is to be stored over seasons and try to maintain stock to a reasonable operating minimum.
- 6.1.7 Display separately from other products in the store through use of partitions or separate enclosures.

6.2 Security and Safety in Pesticide Storage Areas

- 6.2.1 All pesticide storage areas should be kept locked to avoid theft or unauthorized access.
- 6.2.2 Regular inspection of the storage area should be undertaken, giving special attention to damage, spills and deterioration. Cleanup and decontamination shall be done speedily, but not without reference to the product manufacturers safety information.

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